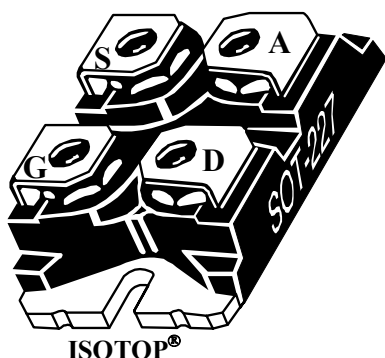
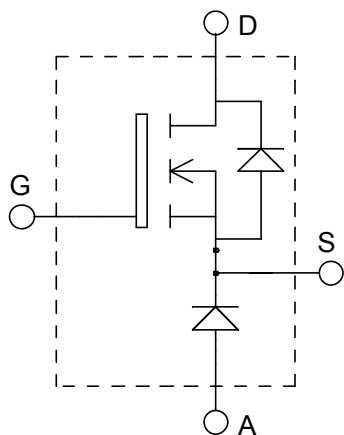


ISOTOP® Buck chopper MOSFET Power Module

$$V_{DSS} = 500V$$

$$R_{DSon} = 100m\Omega \text{ max @ } T_j = 25^{\circ}C$$

$$I_D = 41A \text{ @ } T_c = 25^{\circ}C$$



Application

- AC and DC motor control
- Switched Mode Power Supplies

Features

- Power MOS 7® MOSFETs
 - Low R_{DSon}
 - Low input and Miller capacitance
 - Low gate charge
 - Fast intrinsic reverse diode
 - Avalanche energy rated
 - Very rugged
- ISOTOP® Package (SOT-227)
- Very low stray inductance
- High level of integration

Benefits

- Outstanding performance at high frequency operation
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Very rugged
- Low profile

Absolute maximum ratings

Symbol	Parameter			Max ratings	Unit
V_{DSS}	Drain - Source Breakdown Voltage			500	V
I_D	Continuous Drain Current		$T_c = 25^{\circ}C$	41	A
			$T_c = 80^{\circ}C$	30	
I_{DM}	Pulsed Drain current			164	
V_{GS}	Gate - Source Voltage			± 30	V
R_{DSon}	Drain - Source ON Resistance			100	m Ω
P_D	Maximum Power Dissipation		$T_c = 25^{\circ}C$	378	W
I_{AR}	Avalanche current (repetitive and non repetitive)			41	A
E_{AR}	Repetitive Avalanche Energy			50	mJ
E_{AS}	Single Pulse Avalanche Energy			1600	
IF_{AV}	Maximum Average Forward Current	Duty cycle=0.5	$T_c = 80^{\circ}C$	30	A
IF_{RMS}	RMS Forward Current (Square wave, 50% duty)			39	

CAUTION: These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.

All ratings @ $T_j = 25^\circ\text{C}$ unless otherwise specified

Electrical Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
BV_{DSS}	Drain - Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	500			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{GS} = 0V, V_{DS} = 500V, T_j = 25^\circ\text{C}$			100	μA
		$V_{GS} = 0V, V_{DS} = 400V, T_j = 125^\circ\text{C}$			500	
$R_{DS(on)}$	Drain - Source on Resistance	$V_{GS} = 10V, I_D = 23A$			100	$m\Omega$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 2.5mA$	3		5	V
I_{GSS}	Gate - Source Leakage Current	$V_{GS} = \pm 20V, V_{DS} = 0V$			± 100	nA

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	$V_{GS} = 0V$		4360		pF
C_{oss}	Output Capacitance	$V_{DS} = 25V$		894		
C_{rss}	Reverse Transfer Capacitance	$f = 1MHz$		60		
Q_g	Total gate Charge	$V_{GS} = 10V$		96		nC
Q_{gs}	Gate - Source Charge	$V_{Bus} = 250V$		24		
Q_{gd}	Gate - Drain Charge	$I_D = 41A @ T_j = 25^\circ\text{C}$		49		
$T_{d(on)}$	Turn-on Delay Time	Resistive switching @ 25°C $V_{GS} = 15V$ $V_{Bus} = 250V$ $I_D = 41A @ T_j = 25^\circ\text{C}$ $R_G = 0.6\Omega$		11		ns
T_r	Rise Time			15		
$T_{d(off)}$	Turn-off Delay Time			25		
T_f	Fall Time			3		
E_{on}	Turn-on Switching Energy ❶	Inductive Switching @ 25°C $V_{bus} = 330V, V_{GS} = 15V$ $I_D = 46A, R_G = 5\Omega$		543		μJ
E_{off}	Turn-off Switching Energy			509		
E_{on}	Turn-on Switching Energy ❶	Inductive Switching @ 125°C $V_{bus} = 330V, V_{GS} = 15V$ $I_D = 46A, R_G = 5\Omega$		843		μJ
E_{off}	Turn-off Switching Energy			593		

❶ Eon includes diode reverse recovery

Diode ratings and characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
V _F	Diode Forward Voltage	I _F = 30A			1.6	1.8	V
		I _F = 60A			1.9		
		I _F = 30A	T _j = 125°C		1.4		
I _{RM}	Maximum Reverse Leakage Current	V _R = 600V	T _j = 25°C			250	μA
		V _R = 600V	T _j = 125°C			500	
C _T	Junction Capacitance	V _R = 200V			44		pF
t _{rr}	Reverse Recovery Time	I _F =1A, V _R =30V di/dt=100A/μs	T _j = 25°C		23		ns
	Reverse Recovery Time	I _F = 30A V _R = 400V di/dt =200A/μs	T _j = 25°C		85		
			T _j = 125°C		160		
I _{RRM}	Maximum Reverse Recovery Current		T _j = 25°C		4	A	
			T _j = 125°C		8		
Q _{rr}	Reverse Recovery Charge		T _j = 25°C		130	nC	
			T _j = 125°C		700		
t _{rr}	Reverse Recovery Time	I _F = 30A	T _j = 125°C		70		ns
Q _{rr}	Reverse Recovery Charge	V _R = 400V			1300		nC
I _{RRM}	Maximum Reverse Recovery Current	di/dt =1000A/μs				30	

Thermal and package characteristics

Symbol Characteristic

		Min	Typ	Max	Unit
R_{thJC}	Junction to Case	MOSFET		0.33	°C/W
		Diode		1.21	
R_{thJA}	Junction to Ambient (IGBT & Diode)			20	
V_{ISOL}	RMS Isolation Voltage, any terminal to case $t = 1$ min, $I_{isol} < 1$ mA, 50/60Hz	2500			V
T_J, T_{STG}	Storage Temperature Range	-55		150	°C
T_L	Max Lead Temp for Soldering: 0.063" from case for 10 sec			300	
Torque	Mounting torque (Mounting = 8-32 or 4mm Machine and terminals = 4mm Machine)			1.5	N.m
Wt	Package Weight		29.2		g

Typical MOSFET Performance Curve

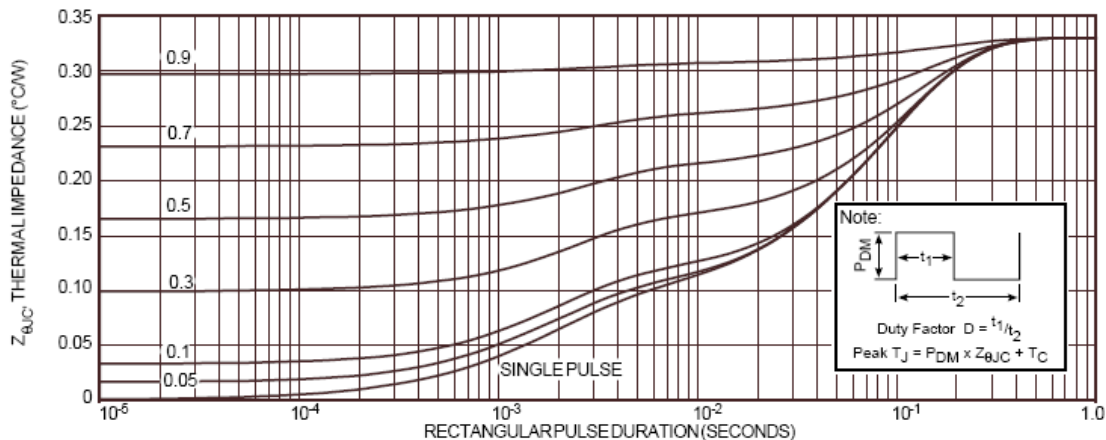


FIGURE 1, MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs PULSED DURATION

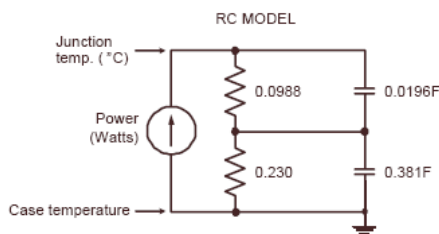


FIGURE 2, TRANSIENT THERMAL IMPEDANCE MODEL

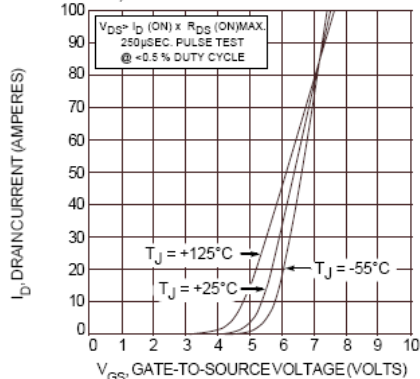


FIGURE 4, TRANSFER CHARACTERISTICS

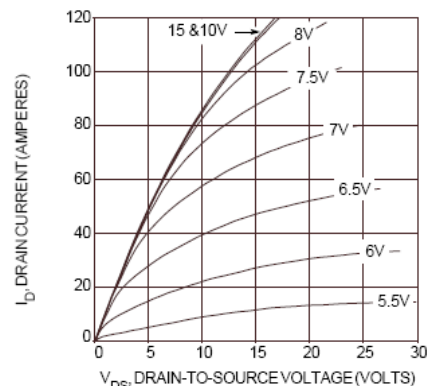


FIGURE 3, LOW VOLTAGE OUTPUT CHARACTERISTICS

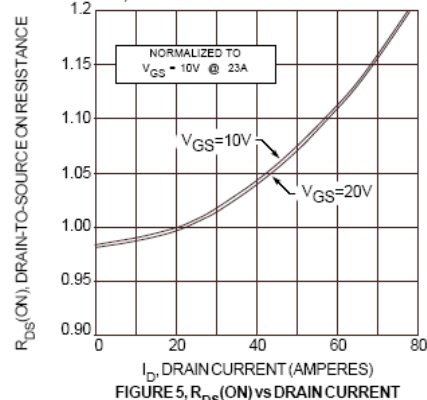


FIGURE 5, $R_{DS}(ON)$ vs DRAIN CURRENT

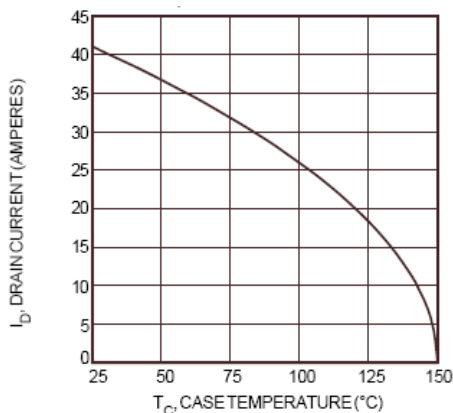


FIGURE 6, MAXIMUM DRAIN CURRENT vs CASE TEMPERATURE

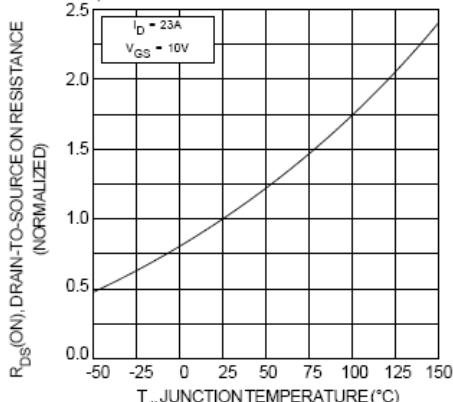


FIGURE 8, ON-RESISTANCE vs. TEMPERATURE

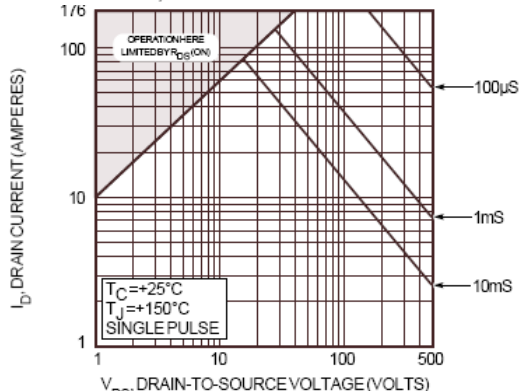


FIGURE 10, MAXIMUM SAFE OPERATING AREA

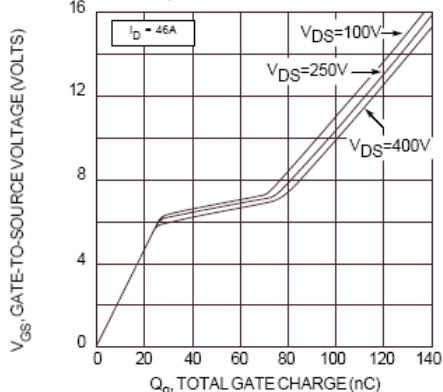


FIGURE 12, GATE CHARGES vs GATE-TO-SOURCE VOLTAGE

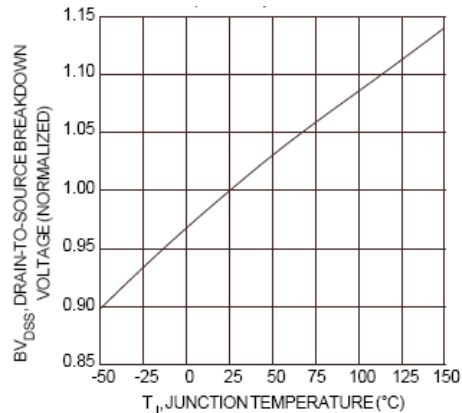


FIGURE 7, BREAKDOWN VOLTAGE vs TEMPERATURE

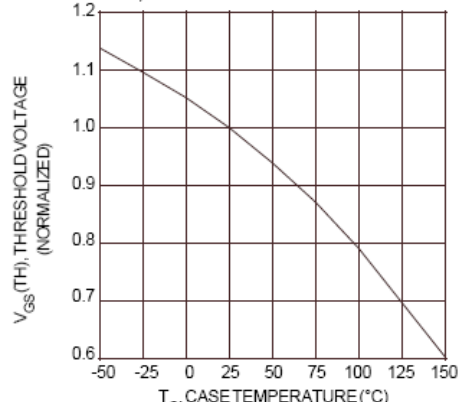


FIGURE 9, THRESHOLD VOLTAGE vs TEMPERATURE

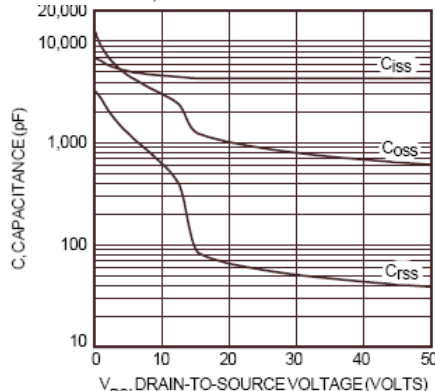


FIGURE 11, CAPACITANCE vs DRAIN-TO-SOURCE VOLTAGE

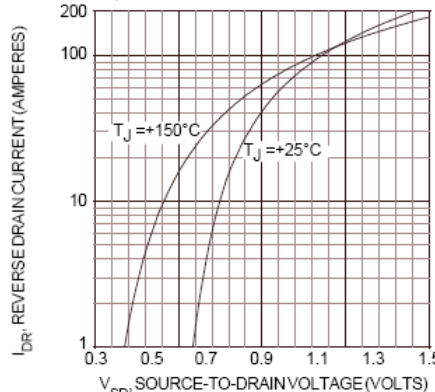


FIGURE 13, SOURCE-DRAIN DIODE FORWARD VOLTAGE

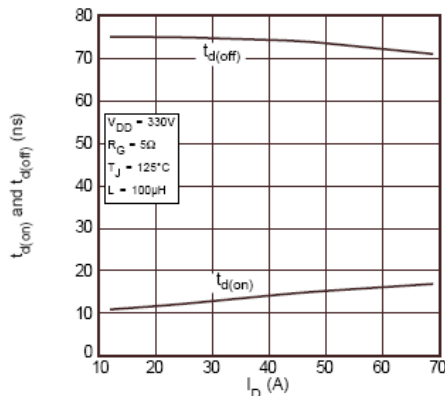


FIGURE 14, DELAY TIMES vs CURRENT

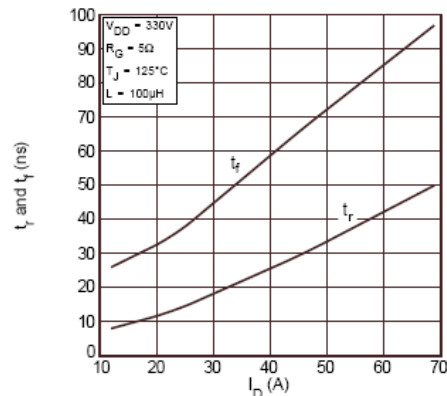


FIGURE 15, RISE AND FALL TIMES vs CURRENT

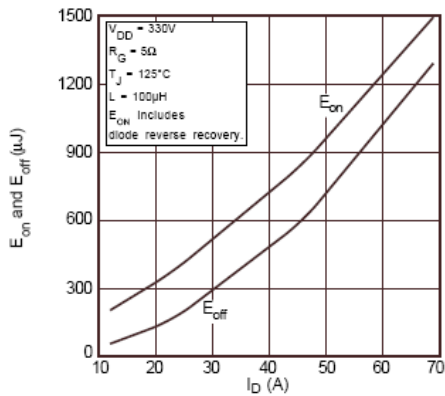


FIGURE 16, SWITCHING ENERGY vs CURRENT

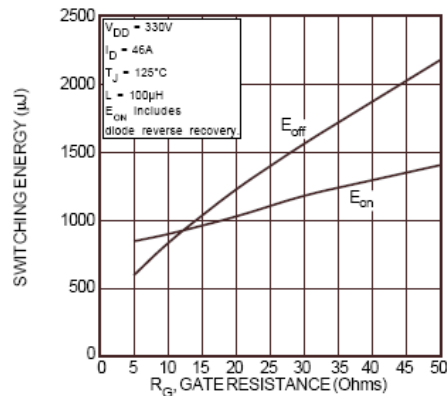


FIGURE 17, SWITCHING ENERGY vs. GATE RESISTANCE

Typical Diode Performance Curve

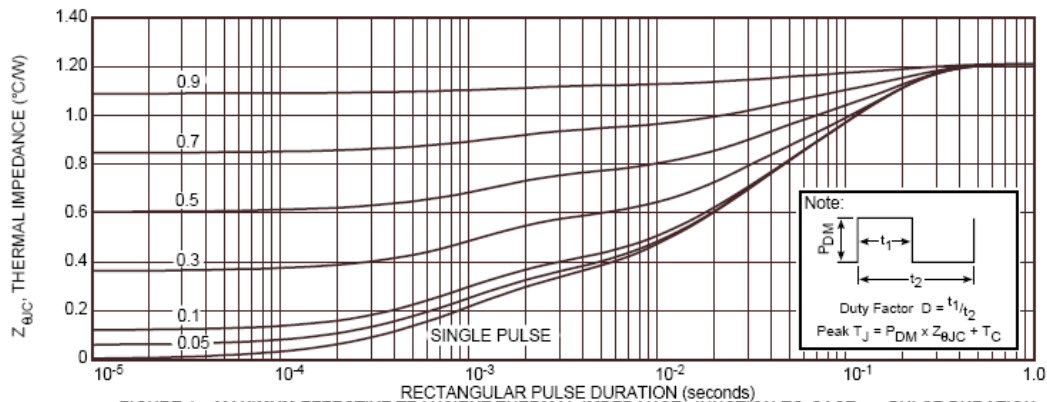


FIGURE 1a. MAXIMUM EFFECTIVE TRANSIENT THERMAL IMPEDANCE, JUNCTION-TO-CASE vs. PULSE DURATION

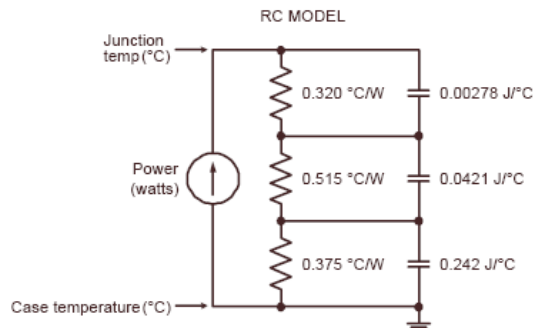


FIGURE 1b, TRANSIENT THERMAL IMPEDANCE MODEL

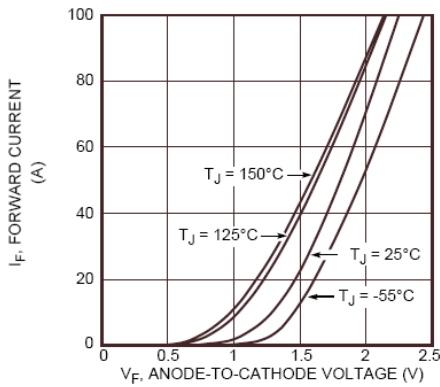


Figure 2. Forward Current vs. Forward Voltage

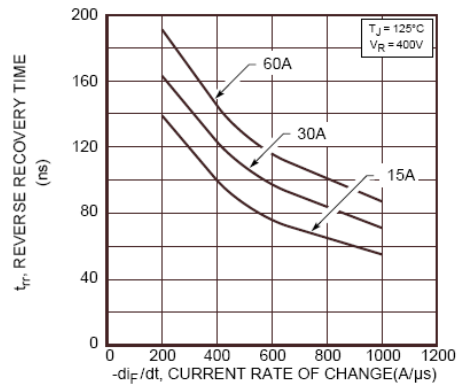


Figure 3. Reverse Recovery Time vs. Current Rate of Change

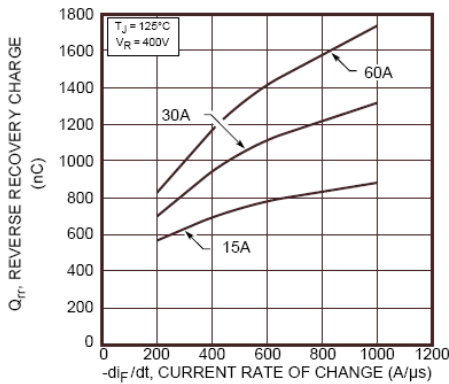


Figure 4. Reverse Recovery Charge vs. Current Rate of Change

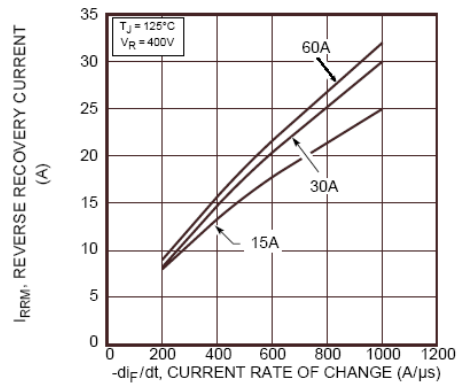


Figure 5. Reverse Recovery Current vs. Current Rate of Change

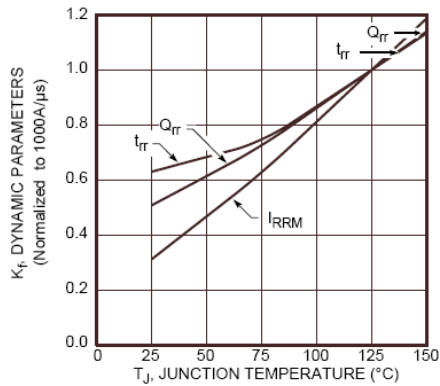


Figure 6. Dynamic Parameters vs. Junction Temperature

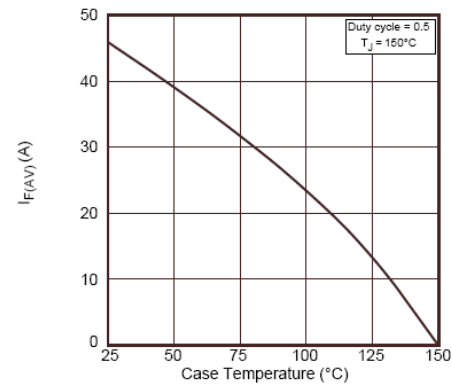


Figure 7. Maximum Average Forward Current vs. Case Temperature

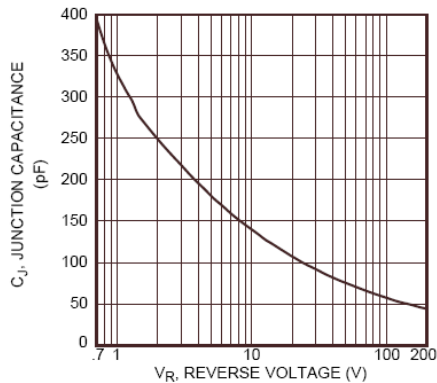


Figure 8. Junction Capacitance vs. Reverse Voltage

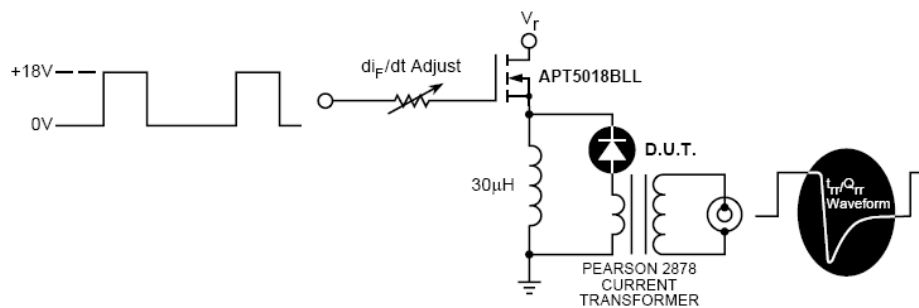


Figure 9. Diode Test Circuit

- ❶ I_F - Forward Conduction Current
- ❷ di_F/dt - Rate of Diode Current Change Through Zero Crossing.
- ❸ I_{RRM} - Maximum Reverse Recovery Current.
- ❹ t_{rr} - Reverse Recovery Time, measured from zero crossing where diode current goes from positive to negative, to the point at which the straight line through I_{RRM} and $0.25 \cdot I_{RRM}$ passes through zero.
- ❺ Q_{rr} - Area Under the Curve Defined by I_{RRM} and t_{rr} .

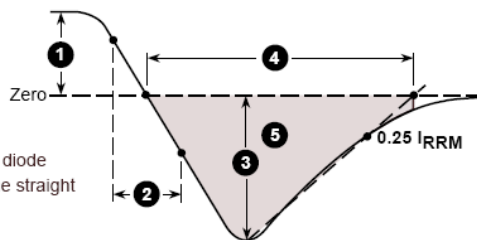
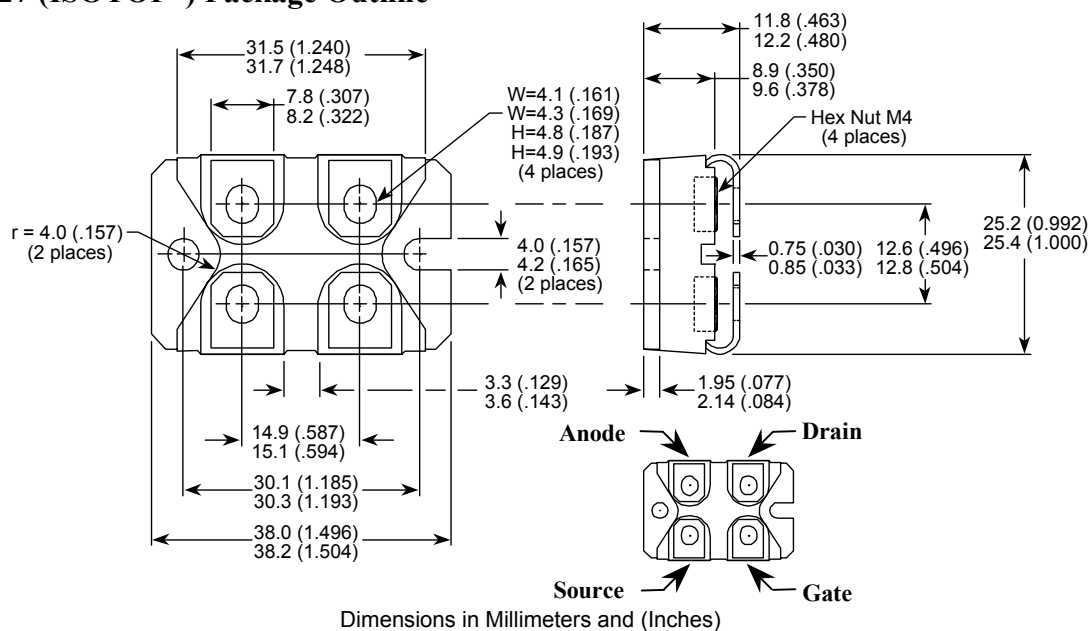


Figure 10. Diode Reverse Recovery Waveform and Definitions

SOT-227 (ISOTOP®) Package Outline



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APT reserves the right to change, without notice, the specifications and information contained herein

APT's products are covered by one or more of U.S. patents 4,895,810 5,045,903 5,089,434 5,182,234 5,019,522 5,262,336 6,503,786 5,256,583 4,748,103 5,283,202 5,231,474 5,434,095 5,528,058 and foreign patents. U.S. and Foreign patents pending. All Rights Reserved.